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AN
ADDRESS
ON
PAINTS

PREPARED FOR THE

BOSTON
ARCHITECTURAL CLUB

BY MR. WM. C. WILSON.

PAINT

Its Adulteration and Some of the Properties of the Chief Paint Materials

AN ADDRESS PREPARED FOR THE

BOSTON ARCHITECTURAL CLUB

BY

MR. WILLIAM C. WILSON

OF

HARRISON BROTHERS & COMPANY—PHILADELPHIA

1893

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RESTON ARCHITECTURAL CLUB

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• • PREFATORY • •

The following address was prepared to be read at a meeting of the Boston Architectural Club, held on the evening of November 30, 1892. Owing to the press of other business and the consequent lateness of the hour, it was necessary to omit portions of it. As many of the members expressed a desire to read the entire address at their leisure, it has been printed in full.

Philadelphia, January, 1893.



PAINT.



IS with much diffidence that I appear before a body of professional men for the purpose of interesting them in a subject which in large measure does not require any scientific study. But, finally, I concluded that its very simplicity has caused it to be largely ignored, and that after all an hour or so could be spent profitably in its consideration.

My subject in general is paint, its adulteration, and as far as time will permit, a consideration of the properties of some of the paint material most in use.

My firm for a number of years past have energetically sustained the proposition that all paints must be true to their names; that an inferior or inexpensive material must not be sold as something of greater value. Such a proposition may be thought entirely unnecessary; that it should "go without saying;" but that it has not been any dogma of the paint business is quite patent to any one who has been or is now connected with that business.

Realizing that our position is the correct one, Messrs. J. A. & W. Bird & Co., have taken the control of our goods for New England and arranged for this address to the end that you who are so deeply interested may be induced to give more heed to the actual quality of the paint material you recommend or order to be used.

From the very nature of his profession the architect, engineer or builder has more or less practical knowledge of the mason's, carpenter's and ironman's work; by simple inspection he can usually determine the quality of the material used by them; but with the painter's work, he is, as a rule, much less familiar and as to the material used by the painter a mere looking at it tells but little, as will become apparent when I illustrate the facility for its adulteration.

Here we have samples of the chief adulterants used. In the order of their use they are barytes, whiting, terra alba, clay and silica. The only one of them familiarly known is whiting, which has numerous other proper uses than as a mere substitute for a more valuable material.

Inspection of Materials.

Chief Adulterants.

Opacity Compared.

Here we have white lead and zinc white; all of these seven substances are white and quite opaque in the dry state, but when mixed with oil to make paint their relative opacity varies greatly. This difference in opacity is, in a measure, illustrated by these transparencies which exhibit white lead in comparison with its would be substitutes. Equal weights of dry material and equal volumes of vehicle are used. With the exception of the barytes all these substances are much bulkier than white lead, consequently give a thicker film when spread over equal surface. Yet, in spite of that fact some of them, you will notice, do not obscure the light any more than the translucent paper used to carry them. These substances have but one-tenth to one-fourth the commercial value of white lead and zinc which are recognized, even by those who most brazenly replace them with the inferior material, as the great orthodox pigments. These cheaper substances are substituted for them to a degree varying with the indifference, credulity or ignorance of the buyer, though invariably received by him under the name of the orthodox stuff.

Body.

These illustrations take us at once to the consideration of body. Body in a paint is simply that quality which enables it to conceal the surface to which it is applied. Or in other words, body is opacity or density as opposed to transparency.

This illustration of relative opacity is an illustration of relative body, approximately, for the body of a paint is mainly its ability to hide the surface upon which it is spread. As these substances of inferior opacity are added to white lead or zinc white the opacity of the lead or zinc is destroyed in almost the same measure. These inferior materials are used for cheapening colored as well as white paints.

In further and more practical illustration of relative body we have here all these materials practically painted on panels in one, two and three coats. They talk more forcibly than I can.

Pure and adulterated White
Paint Compared.

In these cans are white paint. Superficially examining either, separately from the other, one would not venture to say which had the greater quantity of white lead in it—both are white, both are heavy, both are smooth and lustrous. This one is strictly pure white lead; this one hasn't a trace of white lead in it; it is 90 parts barytes and 10 parts zinc white. Difficult to believe, I grant you, but there are large quantities of such trash sold. In fact, the great bulk of the white lead, so called, in one and two pound cans, is of this composition, or very close to it.

Extent to which Adultera-
tion may be carried.

These inferior materials are used for cheapening colored as well as white paints, and in illustration of the degree to which adulteration may be practised at the cost of the non-critical consumer, I have here some Prussian blue. In this jar is some of the same thinned out to permit the ready admixture, by simply stirring it in, of fifty times as much barytes. You will notice very little change in color, in fact none at all at a distance. The solid portion of this paint contains two per cent. only of actual color; it is for the most indifferent trade that adulteration is carried to such an extent; but until very recently it was a somewhat difficult matter to find a Prussian blue ground in oil that had in the

solid portion of the paint 50 per cent of actual color, and within very recent date 25 per cent. would have represented the average quality of the *best* offered. To show pointedly the difference between this cheap adulterant of paints and white lead, I will mix with the Prussian blue in this jar fifty times its weight of white lead, both of them thinned with oil to permit of ready admixture, and you have but a sky blue.

This question of adulteration has been taken up very earnestly during the past three years by the master painters' associations. In January last, by invitation, I addressed the Pennsylvania Association on the subject of color testing. How deeply the members were interested was shown by their close attention for the whole of an afternoon. It was intended that that address should be the basis of this evening's work, but as a copy of that will be sent to any one interested, on application to Messrs. J. A. & W. Bird & Co., or to Messrs. Harrison Bros. & Co., and as I do not consider any mere method of testing so important as showing you the possibility and probability of adulteration in paints, I take up that side of the paint question, in preference, for the purpose of impressing on you the desirability, yes, necessity, of the same supervision of the quality of paint material employed under your direction, as you give to the quality of the material which is more strictly structural. Especially in iron and steel construction is the paint problem of prime importance to you.

Desirability of Supervision
of Paint Material.

It seems to me that it is greatly to the interest of architects, engineers and builders generally to encourage these associations of master painters, and to work in harmony with them wherever practicable. They should be stimulated and encouraged to a continued study of the paint problem which they are beginning to take up scientifically. I have had contact with them directly and indirectly, and can affirm that their work has been of the utmost benefit to the craft as a whole, although their total membership is but a fraction of it. They are gradually establishing a high standard for membership to the end that membership will be regarded by the public as a guarantee of the highest integrity in workmanship. That such an end is a most desirable one is not to be debated. Nor is it to be debated that paint making and painting offer a very wide field for successful deception, and to guard against this, and for many other reasons, should these associations be looked to as amongst the constructor's most useful allies.

The relation of Master
Painters' Association to
the paint problem.

It should come, and I believe it will, that membership in an association will be sufficient reason for entire confidence by the architect in the master painter, whether or not he has previously known him.

There is not the remotest suggestion in the foregoing that the architect should surrender that independent position which secures the impartiality and fair judgment which is characteristic of the profession. On the other hand the architect is responsible for bad work in painting if, as is too frequently the case, he allows himself, generally at the importunity of the owner, to estimate the cost of work in that line at three-fifths of a fair price. It is the opinion of many of the most thoughtful master painters that the remedy for this is to make the painting a separate contract and see that only reputable men are allowed to estimate on it.

When the Architect is re-
sponsible for inferior
painting.

To quote the words of a very observant man: "The habit of making the painter's work part of the carpenter's specifications is very pernicious."

As the painter gives the finishing touches to the architect's creation, surely then they should be in direct touch to insure success; and certainly the reputable painter is anxious that his work shall be highly creditable to him, and shall be satisfactory to the architect and admired by all others.

I repeat that it is to the interest of the architect to encourage that sort of association which will secure from the painter integrity of workmanship and its best development. Why is it that a frescoer who values his reputation and whose work is not exposed to the weather will carefully give five or more coats of white lead for his ground work, while exterior work is practically limited to three coats of paint, and that often slighted in material and labor because dishonest competition may have rendered it impossible to do proper work without loss?

Indefinite Specification.

The subject just dwelt on seems to me so closely related to the theme of this evening that I have purposely enlarged on it. Now we will again take up adulteration. Indefinite specification may innocently lead to the use of improper material. I will illustrate by reciting a case of actual and recent occurrence. "Oxide of iron paint, red or brown" was specified as the paint for an iron structure. By common consent Venetian red and red oxide of iron are regarded as synonymous terms in the paint trade. The painter taking this contract thought red would look nicer than brown, and inquired of his dealer for red oxide of iron; he was told that it could be supplied at three cents per pound and upwards according to quality—meaning Venetian red. Four cents was finally agreed upon as the price. The painter got a nice working paint; made a creditable job in appearance and requested payment. At the last moment, in fact after the scaffolding had been removed, an inspector requested samples of the paint and oil used. The oil was declared pure and satisfactory, but the so-called red oxide of iron paint was found to contain less than four per cent. of oxide of iron, and payment for the work was withheld.

How to avoid doubt as to meaning of Specification.

Without considering the fact that the inspection should have been made at the beginning, and not at the end of the work, the painter, according to some of the best authorities, could not be held. First, it must be recognized that any paint is an oxide of iron paint which is colored by oxide of iron, without regard to the percentage of coloring. Secondly, the specifications were not in any sense specific. While the paint used was in my opinion a poor sort of a paint, yet if the best of the kind as ordinarily sold had been used, it would not have contained over twenty per cent.. Now the specifications easily could have been drawn so as to have avoided any doubt. If the architect believed a certain proportion of oxide of iron should have been in the paint, and certain other things should not have been there, such requirements could have been stated readily. As, for, instance, "to be painted with a well prepared oxide of iron paint containing not less than forty per cent oxide of iron and free of whiting and barytes—color equal to a bright Venetian red" or "color of architect's selection." A complete understanding could then be arrived at between the architect, painter and paint-maker.

Now, in this jar we have a pure bright red oxide of iron; about the most costly of the oxide of iron paints. I do not know of any extended use of it in the pure state for painting.

Red Oxide of Iron.

Here is the same combined with sulphate of lime in the proportion of twenty per cent. of oxide of iron and eighty per cent. sulphate of lime; this represents the standard of the best quality of Venetian red in brightness of color and percentage of oxide of iron. Now, to make low-priced paint it is the custom of the paint-maker to reduce this stuff with whiting and barytes—a common mixture is, say, twenty per cent. Venetian red, forty per cent. whiting and forty per cent. barytes; here in this package is just such a paint, and a little figuring will show that it contains not over four per cent. oxide of iron. Painted out on iron it looks well. Here is one made from a cheap mineral red, containing upwards of fifty per cent. oxide of iron; it does not look nearly so well; and because of certain inherent deficiencies I question if it be any better paint in spite of its large contents of oxide of iron; and certainly this four per cent. paint, free of any corrosive material, is better than an eighty per cent. paint made from pyrites cinder and containing sulphur in a state which will permit of its oxidation into active sulphuric acid. I know of cases of serious damage from this cause, and one paint-maker had a big law suit to handle because of it.

Venetian Red.

Danger of Oxides of Iron
containing Sulphuric
Acid.

How may the architect prepare his specifications to cover these points? Personally, I think a very good plan is to communicate with a reliable manufacturer who has given some attention to the adaptability of paint for a certain work, and who will candidly take up the subject with him. There are many paints that have not any recognized formula, and particularly when such are required, as in the case recited, there should be a complete understanding. The position that we have taken in this matter has driven us to give formulas of composition on labels. For instance, concerning oxide of iron paints, I will read from the labels on these cans. This suggests another important matter. A paint which does not bear a maker's name will be, in all probability, low down in quality. Every paint maker who supplies general trade must provide for a demand for low-priced goods in certain staple lines; such as whites, blacks, reds, ochres, browns, etc. The designing contractor may say to the architect: "This is Blank's red oxide," and it may truly be of Blank's make, and yet, of a quality which Blank would not for a moment recognize as Blank's. This is of frequent occurrence.

Formula of Composition on
Labels.

Unfortunately, it does not follow that, because a paint bears a maker's name it is of best quality; particularly in colored paints.

We have here some pretty strong evidence in support of that statement. About two weeks since we bought five cans of lamp black from first class stores of your city, all bearing well known names. In every case there was a direct assertion of purity. Only one was pure, and that of a low grade as you will notice by its staining power. The adulteration of the others averaged over forty per cent.; one as high as sixty-seven per cent.

Tests to show quality of
some staple colors as now
offered by the market.

We bought in same way some cans of chrome yellow, only one was pure and of fair quality; but not equal to the standard adopted by us—a standard no higher than any able color maker can equal, if he be willing to.

We bought also some cans of Prussian blue. All were inferior. One of them showing less than twenty per cent. of actual coloring.

These panels only show the staining or tinting power of these colors in comparison with the Harrison colors of the same name, which are represented by the deeper tint. The blue and black tints are one part of color to one hundred of white lead. The yellow, one part color and fifty parts white lead.

If any one consider these colors good enough he should certainly see that the price is strictly proportional to the quality; but the danger lies in the fact that when one makes adulterated goods to sell for pure he cannot resist the temptation to degrade his standard as competition lowers his price. An architect or engineer who has determined on any special combination of paint material can very readily insure its integrity to formula if he will learn from the painter who is to make the paint, and then see that the maker understands the specifications and adheres to them. Our agents in Boston will render such assistance as their own large experience, and the backing of the Harrison laboratories and factories, especially fit them to give in the preparation of specifications or the insurance of those prepared by the architect or engineer.

Red lead is a pigment with which one should be well acquainted. As we will see later on, it is of prime importance. Red lead with the brand of any corroder need not be questioned as to purity, and there need be no uneasiness on that point. The painter, however, is often tempted to use other stuff with it, particularly whiting, to make it work better, because, while red lead, as it leaves the corrodors' hands, is invariably pure, it is oftener poor than good. Red lead should be perfectly fine and readily make a good working paint with raw linseed oil; it is oftener coarse in texture refusing to work well.

Bright rich color generally indicates fineness and good quality, but the color of red lead is of no consequence whatever if it possess otherwise the requisite qualifications. Red lead is simply a red oxide of lead, and the best type for painting is orange mineral. This is made by roasting white lead; the finer the white lead the better the orange mineral. Red lead proper is made directly from the metal, which is first oxidized to litharge, the yellow oxide, then to the red. For all chemical purposes, as glass making and pottery, this is the form of red oxide of lead to use; but it does not give so good a *paint* as that made from the settlings, tailings and scrap of the white lead works.

That sort approaches the genuine orange mineral in character. A good test for the requisite fineness of red lead when used for painting is to mix it directly with the raw linseed oil, with very little dryer, and paint it on an iron vertical surface, where it should dry without running or separating. These plates show the difference between a good and bad red lead for painters' uses, both pure. I think if orange mineral were better known it would be frequently specified, in spite of its greater cost. It makes a more compact paint, carries more oil, and works better and freer. Ordinary bright red lead and white lead in oil are sold at practically the same price, and as 100 pounds of white lead give only 75 to 80 lbs. orange mineral, the cost of the latter will be some 40 per cent more. We have here red lead made from the metallic lead only; that made from white lead scrap, etc.,

Danger of the Standard of
Adulterated goods being
lowered.

Red Lead.

Orange Mineral.

Test for fineness of Red
Lead.

and the genuine orange mineral; also some illustrations of their relative opacity and body. It will be observed that the good preparation of red lead is quite as important as actual purity. Consideration of red lead naturally brings up the subject of the painting of iron.

The responsibilities of the modern architect are much increased by the use of iron and steel in structural work, and much of this being put out of sight entirely by fire proof coverings, it is important that a reliable rust resisting coating be employed; and the question is not so much one of dollars and cents as it is of the safety of lives and property. The railway engineer has, of course, the most serious phase of the problem to contend with, because of the constant exposure of all his iron work to the corrosive gases generated by the locomotive fires. Much has been said and written on this subject, and the different materials have each their strong advocates, but at the present time I believe the consensus of opinion is that pure red lead is the most reliable coating. Many European authorities have advocated iron oxide, in spite of the well known fact that iron oxide, under certain conditions, excites rust rather than prevents.

It is claimed that the usual linseed oil paint, as a rule, is not impervious to moisture or vapor; that, in fact, it is quite porous, and were this not the case wooden surfaces so protected would not retain vitality; and Dr. Dudley, of the Pennsylvania Railroad makes a special reference to the fact that the most persistently active rust producing agents, carbonic acid and moisture, are generated in the drying of linseed oil; and further, that the ordinary rust (which is a hydrated oxide of iron, often containing more or less carbonate of iron) is credited by chemists with imparting to the metallic iron, immediately under it, some of its oxygen and water, and replacing this loss from the atmosphere, or from any other available source, acting as a carrier of the necessary elements; or, as one writer has expressed it, "rust begetting rust."

Carbonic acid, independent of its forming carbonate of iron, appears to have a solvent action; that is to say, the hydrate appears to be soluble in this medium, and whatever effects solubility aids decomposition.

This simply takes me to the important point that the successful painting of iron, regardless of what the material of the paint itself may be, depends primarily upon the surface of the iron being perfectly clean. It is apparently proven that there is not a better original protective coating than the pure linseed oil applied while the new iron is still hot, and therefore clean and perfectly dry; the quick drying of the linseed oil, induced by the heat of the iron, preventing any action on it from whatever destructive agencies may be generated from the oil itself. Not only must the iron be perfectly clean, but it must be absolutely dry. No one can expect to have iron well protected by a coat of paint, if the paint be applied while the iron is cold and the atmosphere humid even if the iron should be perfectly clean.

There is little doubt about the protective quality of pure red lead applied to perfectly clean, dry iron. Red lead dries up linseed oil almost entirely by saponification, forming a pure lead soap; and there is not that sort of oxidation of the oil which takes place when it has to dry in the presence of inert pigments or those

Painting Iron Work.

Linseed Oil Paint not impervious to moisture

Iron must be clean.

And dry.

The action of Red Lead Paint in drying.

Proper application of Red Lead Paint.

Zinc on hulls of U. S. War Vessels.

Quality of Oxide of Iron if used on Iron work.

Lamp Black as an inert paint material.

Anti-Rust.

Iron Pipes painted with Anti-Rust, and subjected to extremes of temperature.

pigments which do not directly combine with it. Red lead should be perfectly pure and of the best preparation, should be applied in a good body, or at the rate of from five to six ounces of the dry red lead per square yard of smooth surface per coat. The paint ought to be ground in a mill, and not mixed by hand as it usually is; but as the hardening or saponification of the red lead paste takes place quickly, it should be ground but a few days before its use, or in other words, not more of it ground up at one time than will be used in a few days.

Over a good first coating of red lead almost any other pigment may be applied. The Government is using a mixture of red lead and zinc oxide over a coat of pure red lead on the hulls of its vessels; but the use of zinc in this case is entirely on account of its anti-fouling property in salt water, due, possibly, to the formation of some chloride of zinc. Zinc white is not especially recommended for finishing iron work subject to ordinary exposures, nor is there any reason to object to it when properly undercoated with red lead.

There is a strong bias on the part of many German constructors to use a pure oxide of iron in place of red lead, and in place of linseed oil for the binder use some entirely neutral vehicle in large measure; but in such a case the oxide of iron should be of the finest character and one that has been furnaceed at a very high heat, because when so treated it is most inert.

Lamp black is a very inert material when perfectly pure and a powerful absorbent, and therefore will carry a large quantity of any binder, and is suggested by some as a protective coating for iron. The thought of having an inert pigment and an inert binding vehicle as the components of a rust resisting paint has led to producing our so-called anti-rust paint. The vehicle dries by the evaporation of the volatile thinner mainly, and not by oxidation or combination and appears to form an impervious coating as elastic as rubber. This ought to be more reliable under the operations of the careless workman, who will not conscientiously remove every vestige of rust before painting. We have applied it to steam pipes which were as hot as steam at 100 pounds pressure would make them, and in fact under such application it gives a better coat even than when applied to a cold surface, and a pipe that has been coated with this and heated to over 200 degrees, and then plunged immediately into a bath of salt and ice fails to show any crack or separation of the paint. Red lead will hardly stand this treatment.

The samples exhibited here have been painted with this material and subjected to this treatment. We will not say that this is any better than good, honest red lead painting, but it will be cheaper, and more reliable when indifferent workmen must be employed.

We have also iron pipes coated two coats at ordinary temperature with lamp black, red lead, metallic brown and pure scarlet oxide respectively, all of best quality and ground in and thinned with linseed oil. When dry they were subjected to a freezing mixture, then heated by passing steam at 100 pounds pressure through them for five minutes. The paint softened, blistered and would have been destroyed if the heat had been continued, and these pipes while heated with steam at 100 pounds pressure were painted with

the same paints, and the heat continued until the paint was dry. Afterwards they were plunged, while hot, in a freezing mixture. This has given somewhat better results, but an examination shows that the oil is quite dead and would soon lose its binding power. Red lead gives the best result of the lot under this treatment, but does not equal the anti-rust paint. It is needless to say that a material like barytes, which has not any affinity, chemical or mechanical, for a binder would be useless for such work.

I have already mentioned the liability of an oxide of iron paint derived from pyrites cinder to contain sulphur in such state as to produce free sulphuric acid in time.

Where one has preference for oxide of iron paint he should be particular to determine that the pigment does not contain any sulphur, excepting in the form of a harmless sulphate, as for instance, sulphate of lime. Iron pyrites is a sulphid of iron,—the sulphur cannot be completely burned out in the ordinary operation, and the remaining portion is generally in a state ready for oxidation.

It is highly probable that this cinder will be utilized extensively for paint making; but such utilization must be under competent chemical supervision.

Many of the iron ore or so-called metallic paints, produced by roasting minerals more or less rich in oxide of iron, show sulphur in a dangerous form for use on metallic surfaces, and they must be discarded. No competent paint maker should use them.

There is much uncertainty in the proportion of oxide of iron in the so-called metallic paints. In this jar is a sample of one of the best known and one of the best altogether. It was labeled as containing such a percentage of metallic iron as would require the material to be solely that particular oxide of iron known as magnetic. As a matter of fact it contains, on the average, less than forty-five per cent. of oxide of iron, or less than half of the quantity of metallic iron advertised. No doubt the error was made innocently; the projector of the paint, perhaps, believed the roasted ore to be not only a pure oxide of iron but the richest. So, he simply inquired the percentage of iron in the richest oxide, and gave that as the quantity in his paint. This paint maker was not Silas Lapham, who, according to the veracious narrative of Mr. Howells, once stirred up Boston society.

We have considered paints from the points of their protective quality and their body, and the influence of adulteration on each. I wish to say a few words about some of the staples not yet touched on, but before doing so we might consider the use of those paints that are usually classed as transparent or semi-transparent; or to express it in another way, those that are used to give color effects in combination with the underneath coats, or with the fixed object of having the under surface plainly shown.

In that work which is more essentially the artist's, and in the work of the carriage painter and the grainer (in fact the successful grainer must be classed as an artist) the quality of transparency plays an important part.

Verdigris, for instance, while a useless pigment for any permanent work gives beautiful effects when glazed over certain solid colors. All the lake colors are

Iron Oxide Paint should
be free from Sulphur.

Proportion of Iron Oxide
in Metallic Paints.

Transparent and semi-
transparent paints.

Staining and Graining

used in same way to a large extent. We have a few transparent colors here and show them on glass before the light.

In the domain of the house painter the translucent colors are essential in staining as well as in graining. Even a color usually classed as opaque may be used for translucent effects when it is ground exceedingly fine, particularly if mixed with a transparent color to a greater or less degree as exhibited by a chrome yellow mixed with Prussian blue, as in the so-called chrome greens. Even so opaque a color as anhydrous red oxide of iron may be made to give a sort of translucency by grinding it exceedingly fine. Burnt sienna owes its color to iron oxide, but in a form of partial hydration no doubt, and it, when well selected, is not only beautiful in its transparency, but invaluable to the grainer and stainer.

We pride ourselves on our graining and wood staining colors, and will show some of the latter worked up in a form to especially assist the architect in a certain class of work.

Interior Decoration Stains

Wood stains ought to be of much more service to the architect than they now are. The main purpose of stains appears to be to change the color of a soft or cheap wood to represent that of a hard or more expensive one, and the results at best are only poor imitations. They deceive nobody and are often entirely without artistic effect. To permit the architect to tone or color the woodwork of a room so as to fully control the entire interior color effect, and yet preserve the strong effects of the natural grain of the wood, which are altogether lost in using paint, our Interior Decorative Stains were designed. The coloring of them is entirely pigmentary and very permanent, fugitive dyes being entirely discarded. When they are used by an experienced workman, who has some artistic appreciation of the beauty of the grain and, therefore, will bring out its best effects, the most gratifying results can be obtained. The grain of white pine is, of itself, very beautiful and full of life and light. It cannot be stained to transform it to oak, or walnut, or cherry, but if stained with some color that will harmonize with the general color scheme of the room, and yet have all the lights and shades of its grain fully preserved, a beautiful effect may be obtained; and an inexpensive interior finish used, to the delight of the client and the comfort of his pocketbook. These panels—of hard wood and of pine—illustrate to a degree, what can be done in this line.

Best effect on White Pine

Of course it is only on wood of the peculiar texture of pine (both white and yellow) or whitewood, that these stains will have their best effect, because it is only on these woods that the hard woody growth alternates with the soft portions into which the stain sinks more deeply. When the stain is wiped off, and wiping it at the proper time is where the judgment is required, the hard parts which have been comparatively unaffected by the stain, will stand out lighter against the darker soft portions, thus bringing into prominence the beautiful satin like grain of the wood. On oak, cherry, or any wood of a uniform hardness, this effect cannot be obtained, unless perhaps, by some such process as the grainer would employ, and this, tending to produce a palpably artificial effect, would not be as artistic as the simple stain, as shown on the oak panels.

The great staple paint is white lead which holds its place as the most

important of paints. Not only are seventy-five thousand tons or more annually made and consumed in this country, but many thousands of tons of zinc white, barytes, whiting and other things are used by the confiding consumer under the name of white lead. While white lead holds the first place in paints and painting, no article in the trade is more often condemned, and it must be confessed that results from it are often disappointing. The chemical affinity of white lead for linseed oil, together with its whiteness and its opacity, give it its virtues, and yet what faults are ascribed to it result from its peculiar chemical activity.

White Lead the great staple paint.

Scientific men frequently take hold of the paint problem and almost as frequently condemn white lead as a protective covering because of its liability to disintegrate. Naturally this suggests the use of an inert material as a pigment base for paints, depending upon a mechanical retention of the oil and upon the permanency of the dried oil rather than upon any chemical combination of the oil and the pigment for permanency.

Frequently condemned by scientific men.

I believe, however, that no one contends that dried linseed oil is a very durable substance on exposure to the elements; but as linseed oil is the only available vehicle that possesses those qualifications necessary to make with pigments a satisfactory paint, we must depend on it, and probably will continue to depend on it for a long time to come. I venture the opinion that the inertness of the vehicle to change is of more importance than the inertness of the pigment. The pigment does not surround the vehicle; it is the latter that surrounds and carries in itself the pigment, and certainly it must follow that if that be actually inert to chemical action, it will hold powerless the most active pigment when it surrounds it with its own impenetrable covering.

Inertness of vehicle more important than that of pigment.

Professor Church, of the Royal Academy, is probably the greatest living British authority on paints, and he states that centuries of trial in works of art show the permanent superiority of white lead as a pigment. Quoting from him: "There are many old oil paintings in which the only perfectly preserved parts are those in which flake white has been used with considerable freedom. Here the continuity of the layer of pigment is intact; elsewhere there are cracks, and roughnesses, and scalings off."

Professor Church on White Lead.

True it is that Professor Church is addressing artists and has not any direct reference to industrial painting, but the relative durability of the different pigments is, by his illustration fully shown, for the artists of old used quite the same pigments that the house painter of to-day uses for his exterior work.

Exterior protective painting is subjected to the quickly alternating influences of rain and sunshine, and it is believed that water is the principal agency of destruction; but that extreme dryness and sunshine are also very destructive is strongly shown by a quotation from a letter recently received from a very intelligent correspondent at El Paso, Texas: "White lead is the only material which can be successfully used as priming. Painting done upon a patent liquid wood filler, so prevalent now, will, owing to the peculiarity of our climate, which is extremely dry, it raining only once or twice during the year, invariably scale off in a month or two." The correspondent alludes particularly to wagon painting, but the

Dryness and Sunshine, destruction of Paint.

Dr. Dudley's advocacy of
inert pigments.

exposure and conditions are not at all dissimilar from house painting.

Dr. Charles B. Dudley, the indefatigable and comprehensive chemist of the Pennsylvania Railroad Company has given much study to the paint problem, and is still at work on it. He has made the most intelligent exposition of the subject of inert paint pigments and their use, that recently has been made, and at this time quite strongly advocates their use. He does not claim, however, that his studies have taken him far enough to lay down, dogmatically, any final conclusions, and his opinions, as now expressed, are not accepted yet, as far as I know, by any number of intelligent painters who have given careful observation to the wear of paint, but, on the other hand, are very strongly combated by several who have watched the durability of paint in a more or less scientific manner.

Too much credit cannot be given the Doctor, though, for forcing attention to this subject. It is not his fault if it is one of the peculiar results of his published observations that several very eminent gentlemen of the paint trade advocate with great zeal the beneficent influence of barytes and other more or less inert and valueless substances, the presence of which was only known to the world at large when the laboratory made known its secrets.

"Old Dutch" process of
manufacturing White
Lead.

In this country the generally accepted best method of manufacture of white lead is that known as the "Old Dutch." Efforts to find other methods have been unceasing and equally unavailing. Every enterprising manufacturer has experimented at great cost; I know that over \$50,000 has been expended in single instances in the effort to develop other methods; as a rule all experimenters working in the direction of the quick processes of precipitation, but all that has been so far done appearing but to have established the fact that only the principles governing the Dutch method will give a satisfactory product. These principles, briefly stated, are that the corroding agencies, carbonic acid, acetic acid and water, must reach the metal in a state of vapor, and that the temperature must be kept within well defined limits. Fermentation is depended upon as a source of supply for both heat and carbonic acid. It is unnecessary to say that the control of a lot of tan or manure is almost entirely empirical, and in that lays the whole weakness of the process as usually conducted.

Difficult to get uniform
product.

In the middle of the stack or bed the temperature may rise to 190 or 200 degrees, while in the other portions it may be entirely too low. High temperature not only checks fermentation, but causes a rapid action of the acetic acid, and cuts off the supply of carbonic acid at the time it is most needed. Seldom is it that a stack will show uniform corrosion; in some parts the corrosion is complete and the white lead firm and dense and well described as china lead, while in other parts it is very incomplete, the product spongy and lacking body. Average corrosions of seventy per cent. of the weight of the metal set, are considered excellent. Forty or fifty per cent. are not infrequent.

A uniform result is produced by mixing together all the product of the stack, and better yet by mixing a number of stacks. Messrs. Harrison Bros. & Co. inherited the white lead business from their grandfather who established it successfully in 1806, and have had about as much experience as any other manufacturers in the country in experimenting, and have

expended about as much hard cash for the pleasure of making the experiments. They believe they have now arrived at a point where they have all the agencies of the Dutch process under scientific control, and are able to produce at all times exactly the desired result in the points of chemical composition, density, fineness, percentage of corrosion and more particularly in beauty of color; so good is the color of their lead—especially that prepared for inside work—that it is a common thing for the unthinking or prejudiced person to charge them with adulterating their lead with zinc white, unmindful of the two facts, that it would not pay, and that the label carries a warranty in the form of a pledge to forfeit the paint and pay costs of analysis if found adulterated.

Dutch process under control.

These samples are well established brands of pure lead, and were taken from packages purchased in the open market. They show what variation of color occurs. Corroders look with leniency upon the discoloration of their product, for great care is necessary to maintain a high standard in color, and besides, when the lead is slightly off colored any deficiency in opacity is not apparent when employed for white work. But for the whitest work the whitest lead is undoubtedly most desirable, as the most skilled painter cannot remove discoloration; and even for tinted work the tints are clearer when very white lead is employed in them. In tinted work the question of opacity is never raised.

Care required to maintain high standard in color in lead.

The fault urged against white lead principally is its tendency to decomposition as exhibited in its chalking, becoming, as it were, a dry powder. Frequently this decomposition is shown in a few months, not usually noticeable on a white surface except by direct contact, but in colored work noticed quickly by the deadening of the color, illustrated by the effect produced when a white powder is mixed in large proportion with a colored powder; quite dark, wet, pale when dry. For instance: Here is some white lead and lamp black in oil spread on a surface. Here is precisely the same mixture without the oil. The difference in color illustrates the effect of the chalking of tinted lead. Various reasons are given for this chalking. The chemical statement is that it is the decomposition of the lead soap aided by moisture and particularly by carbonic acid. Without any doubt poorly prepared, especially poorly washed lead, will chalk more speedily than well prepared lead; and no doubt badly prepared linseed oil will hasten the action.

Chalking of white lead.

One of the products of corrosion is sugar of lead, and this should be completely removed by washing. Sugar of lead has a tendency to toughen or thicken the oil, and it is not a rare practice to purposely leave it in the product when it is coarse and grainy, as then it aids to hold together the particles, making the paint work fairly well under the brush; whereas, if well washed, such lead would be rejected because of its coarseness and tendency to settle when made up into a paint.

White Lead must be free of Sugar of Lead.

Concerning the purity of white lead, no one need have fear if he assure himself of it being the product of a corroder, because there is not a corroder in the country that would countenance adulteration, and again the test for purity is so simple that any one can make it in a minute or two. This simple test is the blow pipe. When the white lead is pure, it is readily reduced to a metal button, as you will observe. But as to the quality of preparation, as I think I have all

Purity of White Lead.

Nothing superior to White
Lead for priming.

ready shown, there is great necessity of discrimination. It is very necessary also to guard against inferior priming. Many think that anything is good enough for priming, and it is not uncommon to use cheap white paint for that purpose, or to mix with white lead, whiting or other cheapening material. If I would be dogmatic on any one point, it is that the priming is the most important part of the work, and that for priming there is nothing superior, if equal, to pure white lead, and it should be the *finest and the best*. As I have already said, with extreme fineness the maximum of opacity is required. Here are two boards, one primed with a very fine white lead and the other with a poorly prepared, coarse article, but, of course pure. Both leads were mixed with the thinners in the same proportion. You will notice that one shows a better covering than the other, which simply means the coarse lead has remained on the surface while the fine lead has been drawn into the pores. The second coat illustrates this. Here you will notice the finer lead has now the better covering.

Relative opacity.

A good illustration of the difference between a lead of good opacity and one of relatively poor opacity, but good in other respects is shown by these two panels of blue tint; both tints made with same proportions of blue and white, one part to one hundred; the pale one represents the stronger white, hence the better one.

If the weaker white were coarser and not of good color, it might be declared when used by the ordinary workman to have the better body, simply because he could cover over a dark surface more readily with it. But fine goods in general, are appreciated only by intelligent and competent workmen, and that is the only class we wish to cater to.

Zinc White.

Zinc white so seldom appears under its own name in general use that it is not as well known as it should be. Because of its tendency to scale and chip, due to the soap formed with linseed oil being of a brittle and shrinking nature, it has not found that favor which makes it any formidable competitor of white lead.

Use in France.

French scientific men, encouraged by their government, have for a long time past urged its use in place of white lead, and in France it is very extensively used; but all that is used there is made from metallic zinc; the greater part that is made in this country is made directly from the ore.

Difference between French
and American process.

There are distinct differences between the two. The French process zinc white is denser, more opaque, makes a smoother finish, and gives altogether a better paint than the American process. It, of course, costs more, and those who use a zinc finish and want the best, must expect to pay more.

Value of Zinc White.

The ordinary zinc white is the basis of most of the ready made colored paints and of most of the cheap white paints sold as white lead. When other substances are mixed with it in large proportion, its tendency to scale is much reduced; or rather it scales off in such small particles as to give more the effect of the flaking of white lead. It has the important property of holding color in tinted or colored work much better than white lead, and therefore can be advantageously used in such work in mixture with white lead for finishing coats. It also makes clearer tints with certain colors than white lead of the usual quality will make.

It has further the important property of resisting the discoloring effect of sulphureted gases which turn white lead; so, for inside work, clear zinc white is invaluable as a finishing coat. It must be remembered, however, that linseed oil in white paint, when shut away from daylight, will discolor very much, and this property is apparent when used with zinc white just as strongly as with white lead. Poppy seed oil, when used as a medium, does not discolor in dark places. Therefore, for interior white finish, French process zinc white ground in poppy seed oil, should be specified: of course, for flat work in turpentine, for it would be folly to grind the zinc white in poppy oil and then thin with linseed oil. Gloss finish, if desired, must be produced by a varnish; the under coats may be lead, and preferably so.

Zinc White for interior work.

Linseed Oil vs. Poppy seed Oil.

We have some panels to illustrate the zinc white, one showing the color of the best American process, and another French process. The difference in the whiteness is quite discernible, I believe, even in this light. The difference in the quality of the tint is shown by these blue panels, one with French and the other American process, but both with same blue in same proportion—one of color to one hundred of white. An interesting exhibit is these dilapidated boards; they have been exposed to the weather since September, 1889, and just removed. At that time they were painted, one, two and three coats, with paints bought in the open market. One of the paints, by analysis, showed a mixture of zinc white, whiting and barytes, two simply zinc white and barytes. The solid white board was painted with one of our own paints, made only from pure white lead and zinc white, the latter in excess. This is conclusive evidence of the greater resistance to the elements of the unadulterated paint, and is conclusive in showing the power of zinc to neutralize the flouring tendency of lead. The fault in the painting of this board is in its not having a white lead foundation, for you can notice on the edges of the seasoning cracks in the wood, a tendency to scale off. Ordinary zinc white was used in this case. I think the French process zinc would have given even a better result.

Weather test of painted samples.

French Zinc made in this Country.

Fortunately, in specifying French process zinc, one need not depend on a foreign source of supply. It is made here of positively better quality than the average foreign made that is imported. This is stated advisedly.

Consideration of zinc white naturally leads us to prepared paints.

Ready prepared paints in paste or liquid form probably have been forced more persistently before the architect for his notice than any other special form of paint. An accurate history of this business since its inception would be interesting, and if the impartial student were to consider the rise of this business and its influence on the paint trade in all its branches, the manufacture, the sale and the use, I am sure he would arrive at some surprising conclusions. I think they have been a most potent factor in the increased consumption of paint, and in making painting, as it were, popular. I think it would be found that prior to the introduction of these goods exterior coloring was confined to white and positive green, with the occasional use of Venetian red. I believe it would be found that the paste form was that first extensively offered, and colored paste paints were a sort of an evolution from a cheap substitute for white lead, composed of zinc

Ready prepared paints.

History

white and barytes. While this mixture worked well under the brush, it would not cover up in painting like the genuine white lead, and it soon became apparent to the observant paint maker that this objection would be removed by taking advantage of the well known fact that the addition of color to a white paint to a very great degree concealed its actual deficiency of covering power, for when colored at all strongly the actual inferiority of opacity of such a paint in comparison with white lead colored to same tint is not discernible, even to the expert, in ordinary use.

Reasons for pushing sale of colored paste paints.

Therefore, by pushing the sale of colored paint an inferior and less costly material could be sold at the value of the more costly article it was represented directly or indirectly to be, and besides, color is more or less attractive to everyone. A love of color is in all of us to a greater or less extent. By judicious advertising the colored paste paint business was quite well developed. Some shrewd men saw the field that lay unworked for a paint prepared ready for use, and by working out the idea, as it were, of making "every man his own painter" began rapidly to develop the field. This plan was greatly helped by the development into a practical and mercantile form of an emulsionized and saponified paint. Zinc white, necessarily, was the pigment base and solutions of silicate of soda and sulphate of zinc and lime water were the principal agents in effecting the so-called saponification. A mixture of these solutions produced compound silicates in gelatinous form; an excess of alkali uniting with the resinous material and oil which were also present.

The use of the emulsion principle.

When all the various materials were thoroughly mixed, an emulsion was formed which was described by a celebrated chemist as "a chemico-mechanical union of an oil pigment with a gelatinized liquid." To make this mixture work readily under the brush it required thinning with a very mobile liquid and ordinary benzine answered best the purpose. From its very nature this paint had to be applied in a thick coat and therefore covered readily. In fact two coats would cover up better than three coats of paint as ordinarily mixed. In drying, due to the peculiar action of the large amount of water and benzine contained, which, of course were all, or nearly all, dissipated by evaporation, the resulting surface was like enamel, and the paint was well called "enamel paint."

White Lead not available.

White lead when mixed with the various materials used in the foregoing described paint is subject to chemical reactions which entirely unfit it for a paint, and consequently it was not used, and perhaps because zinc white was the only available white base the almost total disuse of these formulas has occurred.

The peculiar destruction of these paints.

As already stated, one of the most valuable properties of zinc white is also one of its objections. It is the property of drying very hard and continually contracting, and in these enamel paints these peculiarities were especially developed, and, as a rule, with most disagreeable effects in the end. There were many instances of wonderful durability of the paint; surfaces well preserved for ten years not infrequent, but generally the persistent contraction of the zinc combination cracked the surface, though as a rule the paint adhered firmly. If it scaled off freely it would not have been so objectionable. In time the cracks widened, the edges of the paint turned in and a surface was produced well described by the

term "alligatored," all the time the paint holding on like grim death; but it was no longer a protecting coating, the cracks permitting the ingress to the wood of the destructive agencies. The repainting of such a surface was about the greatest terror the painter had to encounter. In short, it was the peculiar manner in which this sort of paint perished that has led to its disuse. Did it perish so as to permit a ready renewal of the surface, I am sure that to-day it would be the paint used almost exclusively for exterior painting. The beautiful, brilliant surface was irresistibly attractive.

Difficulty in re-painting.

Large prices were obtained, profits were very great and, of course, imitation and competition rapidly resulted, in the end producing one of the most prolonged and interesting suits in the paint trade. But ready mixed paints had come, and had come to stay. In the abandonment of the chemical mixtures the makers then decried the use of water and benzine, and to a large degree abandoned it, really a confession that they were unable to practically apply the valuable and useful principles which had been developed. Almost without exception, however, these water-free paints depend upon zinc white as the white pigment base, but reduced severely with barytes, whiting, clay or some other cheap reducer which would not interfere too much with the working of the paint. White lead could not be used in sufficient extent to secure the benefit of its valuable properties, for white lead when long mixed in a state ready for use becomes fatty, non-drying and useless, therefore all of these makers were compelled to practically ignore it, and with great show of virtue vituperated the use of benzine and water. While without a doubt an emulsionized paint, as described, is, when made on a strictly honest and scientific basis, one of the best of paints which has linseed oil for a binder, the prejudice which has been excited against the use of water and naphtha has driven the majority of manufacturers to endeavor to avoid their use, or, at least, not to admit it.

Change in composition.

Tendency to fattiness of White Lead makes it difficult to use in prepared paints.

There are some makes of mixed paints in the market which are not emulsionized, and which do not contain barytes, whiting or other cheapeners; the base is almost exclusively zinc white; in only a few instances is some white lead used; but any analysis that I have seen has not shown over twenty per cent., and this, I think, is rather large a percentage to permit the paint to keep in good working order any length of time, particularly, if much drier be present.

Our own experience with ready mixed paints has been evolutionary. As the enterprising houses generally were adding a ready mixed paint branch to their business, we added it to ours to keep abreast of the times. We negotiated with a manufacturer, who was doing a successful business, to sell us his formula, paying for it a large sum. After a year or two of trial we were satisfied that the formula was very unreliable, and then commenced gradual changes. The formula we, in common with all others, first used, actually required that a gallon of paint must not exceed nine pounds in weight and zinc white was the only white pigment base. Gradually the emulsion principle was almost eliminated. Caustic lime and silicate of soda were entirely discarded; and finally a paint prepared for working out under the brush just as plain white lead in oil is, instead of being flowed on as a varnish as originally required. In other words, the

Our own experience with ready mixed paints.

Chemicals discarded.

Experienced Painter vs.
the Amateur.

demand of the experienced painter was considered and not that of the amateur.

White lead was introduced at the beginning to counteract the scaling tendency of the zinc white, and the proportions have been increased gradually until now we have between 35 and 40 per cent., and the weight is from 14 to 15 pounds per gallon, with less than one tenth of one per cent. of emulsionizing components. All volatile material, of course, is dissipated in drying, and without doubt some of the moisture present goes to hydrate the zinc white; and Dr. Dudley gives it as his opinion that this is an important feature of this mixture, claiming that some hydration of the zinc white gives it more elasticity in combination. The resulting film of dried paint, of course, is nothing but white lead, zinc white and linseed oil, with the solid and permanent portions of any dryer that may be used; but the quantity of dryer required is reduced to a minimum by a previous oxidation of the oil.

Coloring material.

Of course, in colored paints, the coloring material is present, but that can always be reduced to the smallest quantity by the use of strong coloring material, and when the strongest coloring material is used it is a very deep tint which requires over five per cent.

Doubtless it is quite clear that strong, full colors like these browns and olives will not permit of the use of any opaque white pigment in their composition.

Superiority of a good
machine mixed paint.

As to the superiority of a paint like "Town and Country" there is abundant testimony from many old line painters, who use it exclusively for exterior work, though the craft, as a rule are suspicious of, and therefore opposed to ready mixed paints. Like in everything else, good painting depends upon the right kind of a foundation. We do not think, for a wooden surface at least, that zinc white makes a good first coat. The soap formed from linseed oil and zinc oxide is brittle and shrinking. A priming coat ought to have the maximum of elasticity. After much observation of the wear of these paints over a priming coat of high class ochre we recommended that, and prepared a paint which we called "Primer and Filler." Even when made from the finest French ochre it was a comparatively inexpensive primer, and that was another reason for recommending it.

"Primer and Filler"

Continued observation has shown us, however, that it is not superior to pure white lead priming, particularly if any boiled oil or much dryer be used with it, and we decided to alter the composition of our primer and filler so it would contain a considerable percentage of white lead. For those who want the highest grade of work we recommend pure white lead *only* for priming, and should anyone desire the advantages on his work offered by a mixed paint such as the above described, and yet have in the painting a maximum of white lead, all of that could be secured by directions something like this:

White Lead Priming.

Priming to be done with strictly pure white lead, finest quality, and raw linseed oil, with minimum of dryer, and plenty of time given to dry.

Second coat with pure white lead colored approximately to the tints selected.

The third or final coats in the tints selected of a mixed paint similar to the one described.

I believe that such work could be depended upon for very satisfactory endurance under ordinary exposure.

But if the very maximum of durability were sought, both in the actual wear of the paint and the retention of color, then for myself I would require the following directions to be followed:

Priming coat to be made of finest quality of white lead tinted to strong lead color with best quality of lamp black and thinned with raw oil only; plenty of time given for drying.

Second coat to be given with machine mixed paint, such as I have described, thinned out with as much turpentine as it will bear.

Third coat with the same machine mixed paint, with as much raw oil added as it will carry, and give good covering.

These directions are formulated after long observation of the results of various practical trials and observation extending over many years.

The peculiar property of zinc white to hold color in tints so well is quite forcibly illustrated by a report of a practical salesman, on a town to which he had been sent for trade. He wrote: "It is quite apparent, from the appearance of the colored work of this place, that it is a lead and oil town, and affords a good field for the right kind of ready mixed paint."

We are not unconscious of a liability to a charge of heresy in not admitting that pure white lead is the best for finishing as for priming, yet we speak entirely from conviction, and in face of the fact that for the past two years there has been vastly more profit in white lead making than in the manufacture of a ready mixed paint such as I have described.

Such a paint is particularly suitable for plastered surfaces; but for such use the paint is applied directly to the work. We have here three panels of plaster which were very "hot." This one is painted with what we consider the typical machine mixed paint; this one with pure lead to same tint and the third one with a common unemulsioned ready mixed paint made of zinc, whiting and barytes, giving it the advantage of a preliminary coat of size. The difference is so marked and so in favor of our typical paint as to require no further comment.

Plastered surfaces of passage ways or apartments subjected to much abuse and which should be frequently cleaned have in such a paint the best protection that paint can give, as it permits of much cleaning and scrubbing without appreciable damage.

The great value of a reliable machine mixed paint, aside from the superior manipulation obtained by machinery over hand work is, that the architect has control of the color effect, which too frequently is not the case for the reason that exterior painting is often done by workmen who may be thoroughly experienced and reliable in the mechanical part of their work, but are deficient in the artistic sense which is necessary to comprehend and carry out the architect's wishes. Interior decoration on the other hand, is usually done by artist workmen in whom the color sense is developed, and who may be safely trusted to work out a scheme that is only suggested to them.

Gentlemen, I feel that I have exhausted your patience, but if the thoughts

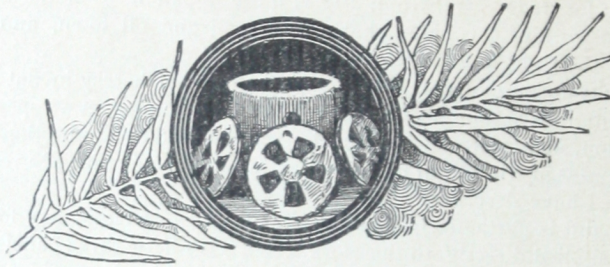
Directions for the most durable painting.

Property of Zinc to hold colors.

Suitability of good machine mixed paint for plastered surfaces.

Architect controls the color effect.

expressed will arouse some interest in behalf of good paint material and good painting, I will not have tired you in vain. On behalf of our agents, Messrs. J. A. & W. Bird & Co, as well as of Messrs. Harrison Bros. & Co., I heartily thank you for your attention.





POINTS ON PAINTS